AMATEUR WORK

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HOW TO MAKE A TELEPHONE.

Newman N. Holland.

I. THE TRANSMITTER.

While the electric telephone is probably the most wonderful instrument that has ever been produced, it is so simple in construction that it can be readily made without the necessity of having many tools or any great expense. By following instructions here given, the amateur can construct a telephone set that will give practically as good service as those in commercial use.

A telephone set consists of really three separate instruments, the transmitter, the receiver, and the signalling bell. We will take up each part separately, commencing with the transmitter, and explain how they can be made with little difficulty and with parts easily procured.

Thf Transmitter.

The first thing to procure is the casing or box to hold the parts, and an old cigar box (Puritanos size) is admirably suited for the purpose. This box should be first cleaned of all paper labels, etc., and brass hinges substituted for the cloth one usually employed. In the exact centre of the corner of this box a hole should be cut about $\frac{7}{8}''$ in diameter. This hole should have its edge bevelled, which can readily be done with a pocket knife, and a piece of pasteboard F, glued inside so as to form a bell shaped funnel such as is shown in the drawing. On the inside of the cover should be pasted a thick cardboard ring H, concentric with the opening. This ring can be readily cut out by means of a compass and a pair of scissors, and should be about 1-8″ thick and $\frac{1}{4}''$ rim, the outside circumference being $2\frac{1}{2}''$. An important part of the transmitter is the diaphragm E. This can be made of a piece of smooth tin or ferrotype plate such as is used in taking tintypes, and can be cut out with an ordinary pair of large scissors. The diameter of this should be the same as the paper washer refered to ($2\frac{1}{2}''$). Before cutting the diaphragm the circle should be struck out with a pair of compasses and the centre marked; through this centre marking, a hole should be made that will allow a 4-32 screw to freely pass. At equal distance around the circumference and $\frac{1}{8}''$ from the edge, four other holes should also be made in the diaphragm so that it can be screwed to the box; make these holes same size as that in the centre. It is now necessary to procure two pieces of carbon which are called respectively the back and front electrode. The front electrode C, is fastened directly on the diaphragm and consists of a circular disk $\frac{1}{8}''$ thick and $1\frac{1}{8}''$ diameter. The centre of this disk is also bored for 4-32 screw and is secured to the diaphragm by passing a screw of that size $\frac{1}{4}''$ long through both carbon and diaphragm, having the head of the screw next the cardboard and using a small brass nut to hold it to the diaphragm.

The next step is to construct a bridge to hold the back electrode D, in its proper position. This may be made of wood. Two blocks should be accurately made of the following dimensions to form posts to hold the cross piece, cut to $\frac{3}{4}''$ x $\frac{1}{2}''$ x $\frac{1}{4}''$. Next make a strip of wood $3\frac{1}{2}''$ long x $\frac{1}{2}''$ wide x $\frac{1}{8}''$ thick. Fasten the two posts which you have already made at the extreme ends of this strip by means of two $\frac{1}{2}''$ No. 4 round head wood screws in each block. In the bridge thus made, a hole is to be bored in the exact centre of the cross piece.

This hole should be large enough to allow an 8-32 machine screw to pass through it.

We now come to probably the most difficult part of the instrument for the amateur to make. This is the back electrode, and should consist of a carbon block $\frac{3}{8}''$ in thickness and $1\frac{1}{8}''$ in diameter.

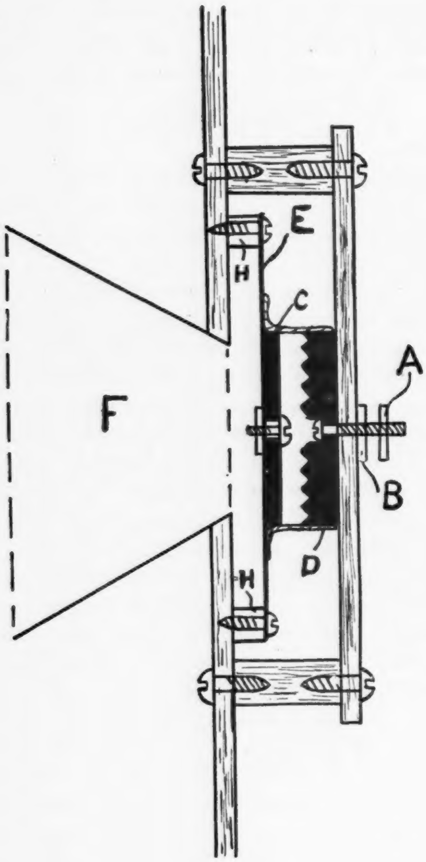


Fig. 1.

The centre of this block is bored to a depth of $\frac{1}{4}''$ with $\frac{3}{8}''$ drill, and the hole continued through with a No. 18 drill. If the reader is in possesion of a small lathe, it is preferable that the face of this disk be scored with a number of concentric ridges as illustrated in the drawing, but while such construction is much better it is not absolutely essential for the working of the instrument.

After the back electrode has been made it should be surrounded with a piece of cloth, allowing the edges to project around the front side about $\frac{1}{4}''$. Almost any kind of woolen cloth will do for this purpose, but it should not be too thick or stiff. The cloth can be glued to the carbon and then should be further secured by winding some stout thread around the outside a number of times quite tightly, and then tying the thread securely. The portion of the cloth which has been allowed to project beyond the outer surface of the carbon should now be frayed by pulling out the threads which run around parallel to the face of the carbon. This will give a light fringe sticking up beyond the carbon, and this fringe should be given a tendency to flare outwardly by pressing the carbon block, fringe end down, onto a smooth surface and seeing that all the threads of the cloth are projected outwardly.

The carbon block is now already to screw on the wooden bridge already constructed. This should be secured by passing an 8-32″ screw through the carbon block and the hole in the centre of the bridge, binding them together with a nut in a manner very similar to that which we employed with the front electrode. The screw in the back, however, should be at least 1″ long as we will use it also to form one of the terminals for connection, and should carry an additional nut beside that used to hold it to the bridge.

We are now ready to assemble our instrument, and although it is necessary to put some granulated carbon between the back and front electrodes, it is better to assemble the instrument first without the carbon to get each part in proper position and then take it apart when such positions have been correctly found and insert the necessary amount of carbon granules.

The bridge with its back electrode should be laid so as to span the diaphragm we have already mounted on the box and adjusted until back and front electrode are exactly opposite one another and the fringe of the cloth fully covers the front electrode. When this position is obtained, carefully mark the position of the posts with a pencil mark all around them, and then after removing same, in each of the spaces obtained drill two holes in such a manner as to allow of putting through two No. 4 wood screws. The bridge can then be replaced carefully and the wooden screws inserted from the front side of the cover.

After the instrument has been assembled in this manner, the four screws holding the bridge to the cover of the box should be removed and the cover itself taken from the box by unscrewing the hinges. It is then ready for inserting the granulated carbon. The granulated carbon should be of the size which is called No. 40 mesh; that is, the particles should be of a size that will just go through a screen having forty holes to the inch. This carbon should be purchased, rather than attempt to make it, and should your local electric supply man not have any in stock, he can doubtless readily procure for you what you require.

Now to fill the transmitter with carbon, the back electrode mounted on its bridge should be held with fringe side up so as to form a shallow cup. This cup should be two-thirds filled with the granulated carbon, that is, so that the carbon grains will cover about two-thirds of both electrodes when the instrument is assembled and held in the position in which it will be used.

The important point to guard against is not to have so much carbon in the space between the electrodes that it will not allow a free movement of the particles.

Next the cover bearing the diaphragm should be laid on top of the bridge, the carbon on the diaphragm coming centrally over the carbon on the bridge. By replacing the screws in the same holes in the bridge posts the exact position would be obtained and the instrument will be completed.

The connections are taken, one wire being placed between the two nuts, A, B, the top nut being screwed tightly down upon same. The other connection is obtained by putting a washer under one of the screws holding the diaphragm, and bending a wire between this washer and the diaphragm, then screwing the screw tight. If the box and mouth piece is now given a good coat of shellac, we can now put it away and construct the rest of our apparatus.

STUDIES IN ELECTRICITY.

XII. PARTS OF THE DYNAMO.

The Commutator of a dynamo, of which previous mention has been made, is a very important part of the machine. Its function is to convey in part the successive pulsations of the currents generated by the coils of the armature to the brushes so that the current in the line shall be practically a continuous one. To make the line current as uniform as possible, it is necessary to have the number of coils in the armature, and consequently the number of segments in the commutator, as great in number as is mechanically possible, when cost and facility of construction are considered. As the mechanical and electrical difficulties encountered are considerable, they determine to quite an extent the design of the armature and commutator.

Each segment must be insulated from those adjacent to it and all of them must be securely held in position on the shaft and yet insulated from it. This involves careful work in the making and assembling of the parts. The material used for the segments is generally hard copper of as great a purity and uniformity of texture as can be obtained. The latter feature is a necessary one, to ensure its wearing evenly. A cross section, as illustrated in Fig. 35, shows each segment to be of a wedge shaped form. Mica, because of its excellent insulating properties and power to resist great heat and pressure, is almost entirely used as the insulating material. Between each segment and also at the surfaces of the ends where they bear on the wedge shaped clamps holding them in position on the shaft, are placed strips of mica free from cracks or ridges. This is shown in Fig. 35.

The Brushes are in contact with the commutator and convey the current to the line. The materials usually employed are woven copper gauze or carbon sticks. The former consists of several layers of fine copper gauze rolled into a suitably shaped bundle and then firmly cempressed and stitched to retain the shape. Excellent contact is secured with this kind of brush, as it is somewhat flexible and has numerous points bearing upon the com-

mutator. It is made of softer copper than the commutator, so that the wear between the two parts will be on the part of the machine most convenient and inexpensive to renew.

The carbon brush is, however, the kind most generally used, having several advantages over the copper ones. It wears a better surface on the commutator, the dust is less injurious to other parts of the machine, being less liable to cause a short circuit; no injury results should the armature be run backwards for any reason. It also causes less sparking, resulting in less heating and therefore less wearing of the segments and insulation. The size of the brushes is determined by the maximum current to be carried with a liberal addition for safety, as with brushes too small, the current generated would develop excessive heat in the armature with very injurious results.

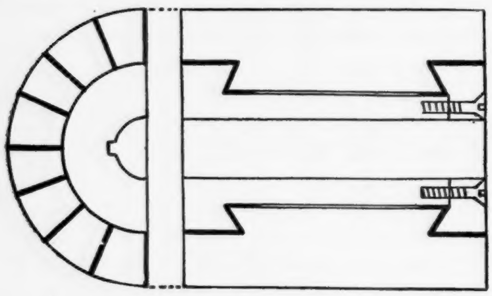


FIG. 35.

THE BRUSH HOLDERS are so constructed and attached to the machine that the position of the brushes and the point of contact with the commutator may be altered as occasion requires. Adjustable springs are attached to the brush holders, the pressure of which give the brushes a firm contact with the commutator. These springs are attached in such a way that little or no current passes through them.

THE FIELD MAGNETS are made of wrought iron, cast steel and cast iron, the desirability of these metals being in the order named. Wrought iron has the highest permeability and is used when a small cross section is required of the field cores. In designing a dynamo it is customary to allow about 90,000 lines of magnetic flux per square inch for wrought iron. Certain grades of soft steel, having a very low percentage of carbon, are almost universally used in dynamo construction owing to its lower cost. It has a permeability almost equal to wrought iron and about 80,000 lines are usually allowed per square inch. Cast iron is the least adapted for dynamo parts, but where size is not important, is on account of its low cost, used for yokes, bases and some other parts. About 45,000 lines per square inch are usually allowed in designing.

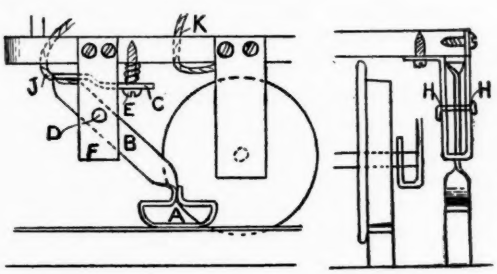
THE FIELD COILS are usually wound on separate forms and when complete, placed on the core. If a metal form is used, such as brass or tin, it is necessary to insulate the coil from the form. In any case the coil must be insulated from the core. Firm paper is usually used for such insulating, being shellaced to keep it from being affected by moisture. The ends of the coil wires, called "leads," are carefully insulated, so that a short circuit will not be formed with any part of the machine which they touch. In large machines with series winding the necessary size of the wire would be so large as to make the work of winding a difficult one, so ribbon copper is used or several smaller wires are used, these being connected in parallel, and serving to secure about the same results as would the larger wire. In shunt windings the shunt wire is wound over the series winding, usually on a separate form to facilitate ease in construction and repair, though it may be wound on one form.

THE United States is fairly running away from the rest of the world in the production of iron and steel. For the first half of the present calendar year, the production was 8,803,574 tons, an increase of 1,130,000 tons, or 14 per cent. over the same period a year ago. A noticeable feature about the industry is that it has made this wonderful increase in the output while the export of iron and steel has very considerably fallen off. The decrease in iron and steel export the last fiscal year is placed at $20,000,000. So enormous and rapid has been the growth of the home demand, that it not only offset the partial loss of the foreign markets and the huge increase in domestic supplies, but also drew heavily upon what may be called the home reserve supply.

MODEL ELECTRIC RAILWAY.

III. EQUIPMENT AND CONNECTIONS.

The equipment of the motor car provides a collector for taking the current from the "third rail" and conveying it to the motor, and a current reverser which will enable the direction of the car to be reversed. The design of the collector is shown in Figs. 4 and 5. The car should have two of these, one on each side, so that at crossings and other places where it may be necessary to place a section of the third rail on the opposite side of the running rails, there will be no break in the feed of the current.



Figs. 4 and 5.

The collector shoe, A, which bears on the third rail, and the shoe arm, B and C, are made from a single piece of ribbon brass 5″ long, $\frac{3}{8}''$ wide and $\frac{1}{16}''$ thick, bent as shown in Figs. 4 and 5. This can easily be done by placing it in a vise and bending the turns with a small wrench; a bicycle wrench answering nicely. Care should be used to make the bends in the right direction, and a cardboard model may first be made to serve as a guide. A hole, D, is drilled in the part, B, to receive a small wire nail, the inside end of which is bent over to hold it in position. Another hole is drilled near the end of the part, C, to receive a screw, E. Around the screw, E, is placed a small spring made by bending brass wire around a large wire nail. This spring serves to keep the shoe firmly in contact with the third rail, and yet allows the shoe to give when meeting joints in the track or obstructions. The screw, E, prevents the shoe from dropping down at switches or crossings, and by touching the running rails, making a short circuit. A little experimenting will enable this screw to be rightly adjusted to secure proper contact with the third rail and yet not reach the running rails.

The support, F, is made from a piece of brass 3″ long, $\frac{1}{2}''$ wide and 1-16″ thick, bent as shown in Fig. 5. Two holes are drilled at the outer end for small screws which fasten it to the car floor; one hole is drilled on the inner end for the same purpose. Holes, H, are drilled through the sides to receive the nail which serves as a bearing for the shoe arm. A slot is made in the side of the car floor to receive the outer end so that it will be flush with the side of the car floor. When the collector is complete and ready to be attached to the car, an insulated copper wire connection, J, 6″ long, is soldered with soft solder to the joint between the parts, B and C, of the arm. The other end of this wire is connected to one of the terminal posts of the motor. Similar wires, K, connect the other terminal of the motor with one of the supports for each pair of car wheels. Use care to see that good contact is secured for these connections.

The current reverser is shown in Fig. 6. A piece of maple or other fine grained wood 3″ long, 2″ high and $\frac{3}{8}''$ thick is needed. This, when all complete, is firmly screwed to the car floor. It may be placed at one end of the car, in which case, a slot for the end of the lever, L, is cut in the top of the car body; or it may be placed near the centre of the car and the lever changed through the doors. In the latter case, the wooden piece must be made shorter or slots cut in one end of it for the belt connecting motor and clock work. Five brass machine screws with nuts are required, though ordinary brass screws may be used; also one piece of brass $2\frac{1}{2}''$ long, $\frac{3}{8}''$ wide and 1-16″ thick, and a similar piece $1\frac{3}{4}''$ long. Bore $\frac{1}{8}''$ holes $\frac{1}{4}''$ from the lower ends of each piece, and make bends $\frac{1}{4}''$ above these holes so that the upper parts will be $\frac{1}{8}''$ away from the wooden support but

parallel with it. Bore $\frac{1}{8}''$ holes in each piece 1″ from the lower ends to receive screws holding in place the wooden cross piece, M, which is $1\frac{3}{8}''$ long, $\frac{1}{2}''$ wide and $\frac{3}{8}''$ thick, this cross piece being on the outside of the brass strips and the screws put through from the inside. The screws should work easily in the holes so that the lever will not be hard to move.

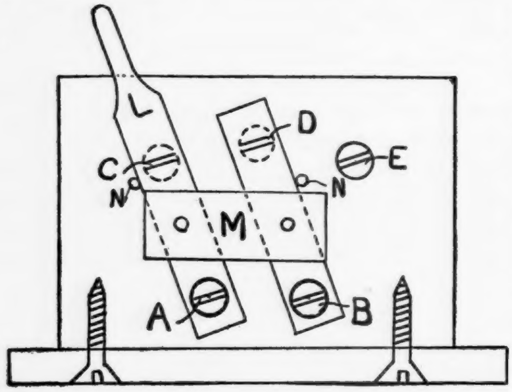


Fig. 6.

In the piece of wood $\frac{1}{8}''$ from the bottom side and $\frac{3}{8}''$ each side the centre, bore holes to receive tightly the machine screws, A and B, Fig. 6, which are put through the lower holes in the brass strips. In the centre and $\frac{3}{8}''$ from the upper edge, put another machine screw, D, and $\frac{7}{8}''$ to each side of it and $\frac{5}{8}''$ from the upper edge put the two remaining screws, C and E. Small nails, N, are driven into the wood to keep the lever from being pushed over too far to either side. After the screws are in position, file the heads a little to make them flat, thus securing a better contact. When this has been done and the lever is in the position shown in Fig. 6, the screws, A C and B D, are connected. If the lever be pushed to the other side, the screws, A D and B E are connected, thus reversing the polarity of the current at the brushes. This result is secured by connecting this switch with the wires leading to the brushes of the motor. An examination of the motor will show that wires are connected to the brushes, one leading to a terminal post and the other to the field winding. Carefully cut these wires, leaving enough wire for new connections on each side of the cuts.

In some forms of motors these cuts can be made several inches from the brushes. Connect these ends with insulated wire, soldering the joints with soft solder, to the switch as follows: A wire from the brush end of one brush wire is connected to screw, D; the other end of same brush wire being connected to screw, B. Connect the brush end of the other brush wire by a branched wire to screws, C and E, and the remaining end of the brush wire to screw, A. The action of the switch should be quite evident.

The current should be supplied by some form of closed circuit battery, a bi-chromate probably being the most practicable to the majority of readers. Descriptions for making this form of battery were given in the December and June numbers of this magazine. If circumstances do not permit of the making of a battery, Leclanche cells with cylindrical zincs may be used, replacing the sal-ammoniac with bi-chromate of potash solution and amalgamating the zincs as directed in the descriptions above mentioned. Several cells will be required, the number depending upon the weight and construction of the motor car and train to be moved. The several cells are connected in series or series-multiple as may be found by experiment to produce the best results with the motor used in the car.

The battery is connected to the rails with insulated copper wire, No. 12 or 14 guage, the zinc pole being connected to the third rail and the carbon pole to each of the running rails. If a considerable length of track is used, two or more connections with the battery are desirable to reduce the resistance of the rails. All rail connections should be made with soft solder, a soldering fluid or paste being used to enable this to be easily done. A switch in one of the battery feed wires for shutting off the current will be found desirable. This can easily be made, with a small strip of brass and two brass screws, using a small block of wood for a base. The zincs should always be taken from the above battery when not in use, as the zinc is consumed while in the solution, whether any current is flowing or not.

The way to make additional equipment for this simple railway, will readily suggest itself to the reader of these chapters.

CHLORIDE OF SILVER BATTERY.

R. C. BROWNE.

As the amateur electrician is usually interested in making small and compact batteries, which may readily be carried in the pocket or used for experiments, the following description of making a chloride of silver battery may prove useful.

The chloride of silver may be purchased all prepared, but a good grade well adapted for the battery, is not difficult to make. A silver coin or piece of scrap silver (not plated ware) is placed in a clean glass tumbler and slightly diluted nitric acid is carefully poured over it in sufficient quantity to completely disolve the silver. A little pure water is added occasionally and the solution should be frequently stirred with a glass rod. When completely disolved, put strips of sheet copper into the solution and the silver will be precipitated. Continue the copper in the solution until all precipitation stops. Pour off the liquid carefully and redisolve the silver in fresh nitric acid as before.

Make a strong solution of common salt and pure water and add slowly to the silver nitrate solution until all precipitation ceases, and then allow it to settle. Pour off the liquid or filter to secure the precipitate which is chloride of silver, and after being washed with pure water, is ready for the battery. The latter part of the above operations should be done in a dim light or a dark room with a ruby lantern, as chloride of silver is sensitive to white light. The washing with water is most easily done by stirring with a glass rod and then allowing it to settle, after which the water is poured off or filtered.

Obtain some pure sheet zinc $\frac{1}{16}''$ thick or, if possible, a few inches of zinc tube $\frac{1}{2}''$ in diameter. If the sheet zinc is used, it must be rolled around a piece of $\frac{1}{2}''$ round wood to form a cylinder and the edges soldered together with a butt joint. Cut the tube into sections $1\frac{1}{2}''$ long with a file and solder a round piece of zinc into one end so as to form a small cup $1\frac{1}{2}''$ by $\frac{1}{2}''$, open at one end. This cup is to form the retaining cell for the battery and also serve as one pole.

Obtain a piece of sterling silver $1\frac{3}{4}''$ long and $\frac{1}{8}''$ or $\frac{3}{16}''$ wide, by rolling or pounding silver wire or by cutting up a discarded spoon or other article, as it is not necessary that it be very thick. A longer piece may be used and the battery will give more current, but in such a case, the strip should be bent back to form two thicknesses $1\frac{3}{4}''$ long. Make a small paper tube about the size of a lead pencil and $1\frac{1}{4}''$ long, closing one end with sealing wax and after putting the silver strip in the centre, ram the remaining space with the chloride of silver. This constitutes the other pole of the battery and should be placed in the centre of the zinc cup; the space between it and the sides being filled with cotton wool or blotting paper.

Moisten the contents of the zinc cup with a strong solution of common salt and water and seal the top of the cup with sealing wax. After soldering connecting wires to the zinc cup and silver strip, the cell will be complete, giving one volt and current enough to ring a common electric bell.

The above dimensions may be changed to meet the requirements of anyone making the battery. I have made them, measuring not over $\frac{1}{2}''$ high. The chloride of silver can be melted and cast around the silver electrode but this is probably beyond the scope of the average reader. Use great care that none of the silver solution gets on the hands or clothing, as it is a caustic poison and will make indelible black stains. Remember to keep the chlroide of zinc in the dark, in fact, it will be well to keep all the chemicals in dim light.

Over 200,000 telephones are reported in use by farmers, connecting their homes with neighboring villages. The wire fencing is frequently utilized for the lines. Many of our readers could easily construct such lines.

PROJECTION.

II. CUBES AND SHADING.

In the projection of solids, the dimensions of length, breadth and thickness, make necessary the use of more than one view for the presentation of an object, that its form and dimensions may be shown in the correct proportions and relation to each other, to enable it to be constructed without other data. It is in this important particular that Mechanical Drawing differs from Perspective or picture drawing.

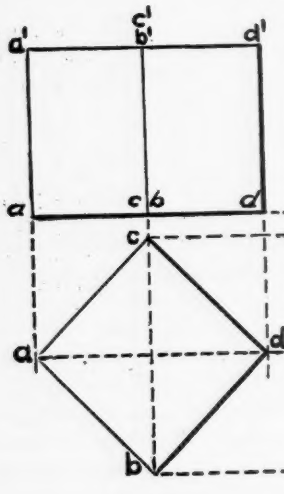


Fig. 11.

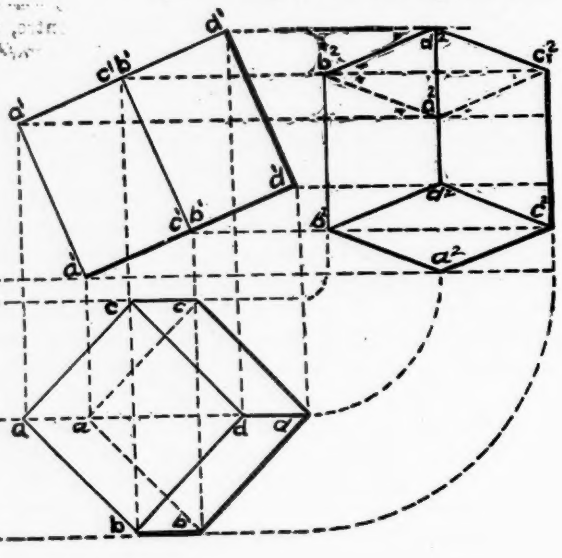


Fig. 12.

The first form to be considered is a cube or solid square which we know has six equal sides or squares, each one being parallel to the one opposite. These different surfaces are shown most conveniently for the required purposes by three views known respectively as the Front Elevation, or front view; Side Elevation, or side view (usually the right side), and the Plan, representing a top view; all of these assumed to be from an indefinite distance, great enough to give to the views a plane surface.

The plan is assumed to be of the same plane as that of the paper upon which it is presented, and the other planes or elevations are at right angles with it, but revolved as though on a hinge until brought to the same plane as the plan. If the reader will construct from a piece of cardboard, a figure with three flat surfaces to represent the above named views of a cube, and then lay this figure flat upon the drawing board, the relation these views have to each other will be more easily understood. The joints or hinges between the surfaces of such a figure would represent the lines of intersection of the several planes, which are called the "Axes of Projection."

The three views of a cube so placed that the nearest side was parallel to the front vertical plane would be alike. If it were turned so that the sides were at an angle of 45° from the vertical plane, the Plan and Elevations would be as shown in Fig. 11; the Side Elevation being the same as

that of the Front Elevation. Draw the Plan of the cube a b c d. From each of the angles of the Plan, draw perpendiculars of a length, above the intersecting line, equal to the side of the Plan. Draw the top line, a^1–d^1, completing the elevation.

Assume that the cube be inclined until the plane of the base is at an angle of 25° from the horizontal plane, as shown in Fig. 12. The Elevation shown in Fig. 11 is placed so that the plane of the base, *a–d*, is at the given angle and as the edges are at right angles (90°) to the base, they will be at 60° from the horizontal plane. From the angles of this elevation, draw perpendiculars intersecting them by horizontal lines drawn from

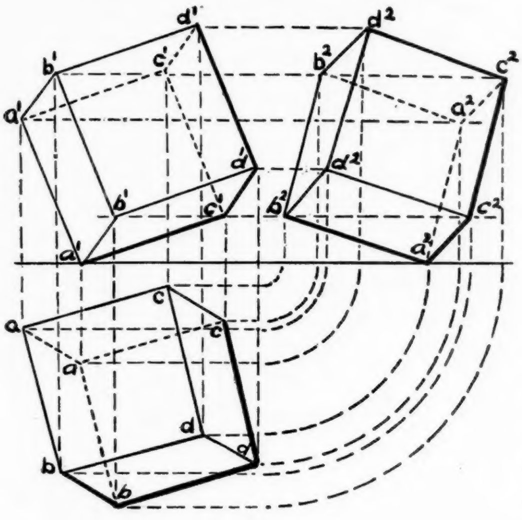


Fig. 13.

the Plan in Fig. 11, and then, drawing the necessary lines to obtain the Plan for the inclined cube. To obtain the Side Elevation, draw horizontal lines to the right from the angles of both the Front Elevation and the Plan. Taking the point where the lines of intersection cross as a centre, describe arcs from the horizontal lines of the Plan and draw vertical projecting lines from these arcs, intersecting the horizontal projecting lines from the Front Elevation. The points of intersection are connected by the lines necessary to complete the Side Elevation.

Assume that the cube, in addition to being inclined 25° from the horizontal plane, is inclined 30° from the vertical plane. Draw the Plan with the lines representing the vertical planes at an angle of 30° from the line of intersection, as shown in Fig. 13. Draw perpendiculars from the angles of Plan and horizontals from the Elevation in Fig. 11. The intersections thus obtained give the points necessary to draw the Front Elevation. By continuing the horizontals to the right, and describing arcs from horizontals drawn from the Plan, using the line of intersection as a radius, and drawing verticals from these arcs, the points necessary to the Side Elevation will be obtained.

The reader who is following these studies without the aid of a teacher, may experience some difficulty in clearly and quickly understanding them, but if several additional problems are tried by varying the angles at which the cube is inclined, the experience thus gained will be valuable and interesting.

Shading.

In a chapter of the series on Mechanical Drawing, the use of shade lines was mentioned, and it was there stated that the light was assumed to fall upon the object from the upper left side at an angle of 45°. In applying this rule to projections however, it is desirable to modify this rule to the extent that shade lines are used only on the right hand and lower edges, as will be noted from the illustrations for this chapter. If the rule were arbitrarily adhered to, the determining of whether shade lines were required or not would so frequently require a nicity of decision and the use of so much time in making it, as to make quite desirable the modification above mentioned. If this is done, the use of shading soon becomes a matter of habit. The lettering adopted for this series makes use of the vertical letter for upper planes and italic for the lower ones. All drawings made by the student should be carefully lettered, both for the practice and clearness of the drawing.

Those who use, in the process of intensification, or bromide print toning, the ill smelling ammonium sulphide, will be glad to hear, on the authority of R. Blake Smith in *Photogram*, that the sodium salt answers the various purposes quite as well, and is almost odorless. The *Photogram* cautions purchasers to be sure they get the sulphide, and not the more generally used sulphite.

A SMALL BOOKCASE.

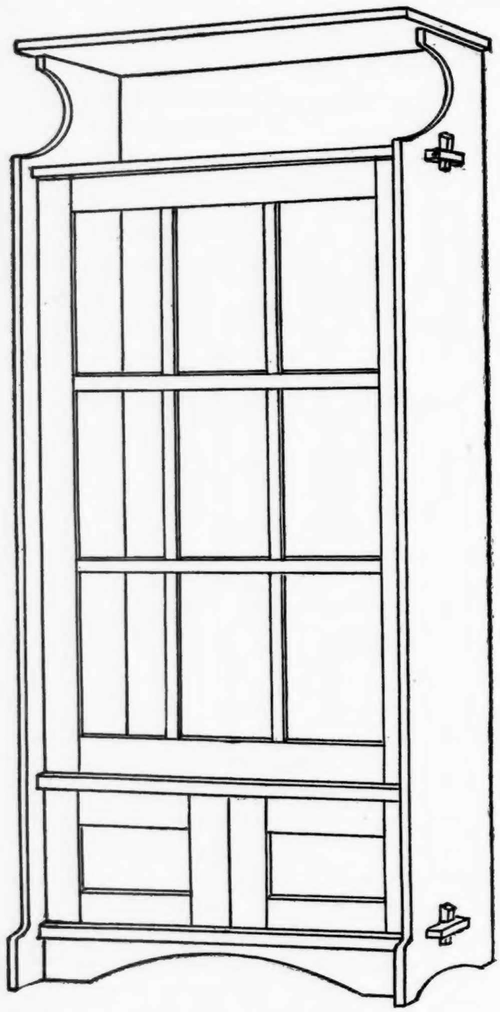
JOHN F. ADAMS.

The bookcase here described may easily be made by anyone of ordinary skill, and will be found both attractive and convenient. The cupboard in the lower part gives a good place for the storage of pamphlets, magazines, and other matter which is not of a form desirable to expose to view. Oak is the most suitable wood for this design but other fine grained woods may be used.

The necessary material is as follows:—2 pieces 62″ long, 11″ wide, $\frac{7}{8}$″ thick; 2 pieces 33$\frac{3}{4}$″ long, 10″ wide, $\frac{7}{8}$″ thick; 1 piece 33$\frac{1}{2}$″ long, 8″ wide, $\frac{7}{8}$″ thick; 1 piece 30″ long, 10″ wide, $\frac{7}{8}$″ thick; 1 piece 30″ long, 3″ wide, $\frac{3}{4}$″ thick; 2 pieces 30″ long, 8″ wide, $\frac{3}{4}$″ thick; 2 pieces 34$\frac{1}{2}$″ long, 2″ wide, $\frac{3}{4}$″ thick; 2 pieces 30″ long, 2″ wide, $\frac{3}{4}$″ thick; 2 pieces 31$\frac{1}{2}$″ long, 1″ wide, $\frac{3}{4}$″ thick; 2 pieces 27″ long, 1″ wide, $\frac{3}{4}$″ thick; 8 pieces 12″ long, 2″ wide, $\frac{3}{4}$″ thick; 2 pieces 12″ long, 9″ wide, $\frac{1}{2}$″ thick; and several strips of $\frac{1}{2}$ clear matched sheathing 48″ long for the back.

The side pieces are cut out at the top and bottom as shown in the illustration; the width at the top being 8″. The proper curve is easily marked out with a pencil, and cut with a compass saw; the saw marks being removed with a draw knife. Mortises are cut in the side pieces to receive the tenons on the ends of the boards at the top and bottom of the cupboards. These mortises are 5″ long and $\frac{7}{8}$″ wide, and placed in the centre of the side pieces; the bottom one being 3″ from the end and the upper one 47$\frac{3}{8}$″ above the lower one. The cross boards 33$\frac{3}{4}$″ long and 10″ wide, have tenons cut on each end, 5″ wide and 1$\frac{7}{8}$″ long. After trying the fit of these tenons to the mortises in the side pieces, cut mortises in the tenons for the wedge shaped pegs shown in the illustration. These pegs are 1$\frac{1}{2}$″ wide, 2$\frac{3}{4}$″ long and $\frac{1}{2}$″ thick at the centre; the mortises for them being cut to bring the pegs snug against the side pieces, and beveled to the shape of the peg on the outer side.

The cross piece between the two sections is 12″ above the lower cross piece and fastened with three strong wood screws, the heads being countersunk deep enough to be covered with putty. The top cross piece is attached in the same way. The doors for the lower cupboard are made as



follows: A $\frac{1}{2}$″ rabbet is cut on the inside edge of all the pieces. The ends of the cross pieces are then halved to fit the rabbet, using care to see that the halving is done on the right side. The joints

are then fastened with glue and ⅝″ screws slightly countersunk. The panels are then put in with glue and screws. A small block of wood is screwed to the centre of the under side of the cross piece above these doors to hold the doors in the right place when closed. Two small hinges are placed on each door and wooden pulls in the centre of the two centre vertical pieces. The piece under the lower cross piece is fastened with glue and screws, and may be cut out as in the illustration or a straight piece, as desired. Pieces 1″ wide and 4½″ long are glued to the lower front edges of the side pieces to make the entension as shown. The tops are slightly rounded.

The door frame for the book compartment must be carefully made. The joints between the side and top and bottom pieces are preferably mortised but may be halved, the inner edges of these pieces having a ¼″ rabbet cut in them. The narrow cross pieces in the door are 10″ apart between centres, the ends being halved to fit the rabbets in the side pieces and halved 9″ from each end to receive the vertical strips which are halved at the ends and where they cross the other pieces. The inner edges of the narrow strips are rabbeted ¼″ wide and ½″ deep for the glass, this being done before halving. A screw is put into each joint from the inside. The glass, which measures 10″ x 8½″, is held in place by narrow strips of wood, held by small nails, the strips being wide enough to make the outer edges flush with the front width of the pieces to which they are fastened.

The sheathing at the back is nailed or screwed to the cross pieces and reaches only to the cross piece at the top of the book compartment. The shelves are held by large screw-eyes put into the side pieces, or cleats ¾″ square, held by screws. The staining and finish should be quite dark, and is left to the selection of the reader.

According to information published by the United States Treasury Bureau of Statistics, there are 1,750 submarine telegraph lines in the world, the aggregate length of which is nearly 200,000 miles. The number of messages annually transmitted over these lines exceeds 6,000,000.

PEAT DEVELOPMENT IN ONTARIO.

A. G. Seyfert, U. S. Consul at Stratford, Ont., writes that hundreds of thousands of dollars have been expended during the past few years in experiments by the different companies in the Province for the perfection of machinery to turn out a fuel that will compete with coal. Under the old process, the bog was cut and sun dried. With new machines, the crude peat is run through the apparatus as fast as dug from the bog. Part of the moisture is evaporated by the heat of the process and the balance removed by the immense pressure the material undergoes, until it drops from the machine in cubes, ready for the market. This process of converting the raw material into marketable fuel is a great improvement over the old method, but further improvements are expected.

The whole question of making the inexhaustible beds of bog commercially valuable lies in the drying process. The genius who will invent a machine to satisfactorily extract the moisture from crude peat will not only make a fortune, but will be a public benefactor.

Thus far, the nearest solution to the problem lies probably in the machine invented by Mr. Dobson, now in use at his peat works at Beaverton, near Lake Simcœ, in northern Ontario. This machine consists of a press, drier, and spreader, and is a most ingenious contrivance, for it cuts, pulverizes, and spreads the material at the same time. This reduces the moisture 50 per cent, and the balance is taken out by the drying process.

Canada annually consumes nearly 3,000,000 tons of anthracite coal, all of which comes from Pennsylvania. The prolonged strike has changed the situation to such an extent that this summer no coal was delivered, and a serious fuel famine confronts the people of this latitude. This condition of affairs has given a tremendous impetus to the manufacturing of peat for fuel all over the Province.

The use in the vinyard district of France of specially constructed cannons to bombard approaching storms and prevent destructive hail, is considered to still be in the experimental stage.

AMATEUR WORK

63 KILBY ST., BOSTON

DRAPER PUBLISHING CO., PUBLISHERS.

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TO ADVERTISERS.

New advertisements, or changes, intended for a particular issue, should reach the office on or before the 15th of the previous month.

Entered at the Post-office, Boston, as second-class mail matter, Jan. 14, 1902.

OCTOBER, 1902.

Contents

How do you like the new cover?

THIS number completes the first volume of this magazine. The cordial reception which has been accorded it by numerous readers in all sections of this country, have been most encouraging to the publishers, and our thanks are extended to those who, by their patronage and kindly expressions of approval, have shown that a magazine of this kind was in sufficient demand to warrant its publication. The many interesting articles which are in preparation cover such a wide field and are so numerous, that no attempt will be made to forestall them, but our readers can rely upon finding, during the coming year, quite enough to keep their leisure time fully occupied with useful and instructive work.

OUR readers are invited to suggest subjects which they would like to have presented in this magazine. It is the desire of the publishers to make the magazine as interesting and helpful to as large a number as possible, and any suggestions which may be offered in this line will be favorably acted upon provided the topics are thought to be sufficient interest to warrant.

ATTENTION is called to the following subscription offer: About two hundred complete sets of the first volume of this magazine are being bound in a strong cloth cover and, while they last, will be offered, together with a subscription for volume two (one year), for Two Dollars. As this offer is limited to the above supply, those desiring them should send their order at an early date.

THE users of anthracite coal who are obliged, because of the scarcity of that kind of coal, to make use of bituminous coal, should use care to see that chimneys are cleaned at regular intervals. The latter kind of coal forms considerable quantities of soot, which, if not removed by sweeping, will unite and burn with considerable flame and sparks. Chimneys should be examined and any defects repaired, and arrangements made for quickly reaching shingled roofs with water should sparks fall upon them during a chimney fire.

WOOD TURNING FOR AMATEURS.

F. W. Putnam, Instructor Manual Training School, Lowell, Mass.

II. DESCRIPTION OF THE LATHE.

FIRST class lathes are now made by a number of concerns, and sold at very low prices, yet are not within the means of every amateur who might wish to own one. The May number of "AMATEUR WORK" contained a very good article on the making of a modern turning lathe frame. This frame can be made at a small cost and, when fitted with a suitable lathe set, will serve admirably for the turning of exercises which follow.

Among the many excellent smaller wood lathes now in the market is the lathe shown in Fig. 3, made by the Washburn Shops of the Worcester Polytechnic Institute, Worcester, Mass. As all modern lathes are practically alike in general construction, let us examine Fig. 3, and learn some thing of the parts of a lathe.

Every lathe has four principal parts:— the shears, the head-stock, the tail-stock, and the rest. The head-stock is stationary, while the tail-stock and the rest are movable along the shears, and may be fastened temporarily at any desired place by means of clamps. The office of the shears or ways is to support the head-stock and the tail-stock in such a position that the axes of their spindles will be in the same straight line, in whatever position on the shears the tail-stock may be fastened. The end of the shears is shown at D, Fig. 3. The shears include the legs E. Sometimes lathes are mounted on wooden benches, and are then known as bench lathes, in which case the legs are very short. The shears have generally two parallel grooves or tracks cut in on or the top surface, in the direction of the line of centres of head-stock and tail-stock. These grooves are V-shaped, corresponding exactly to bosses which project from the under side of the head-stock, tail-stock and the rest. The head-stock, shown at A, Fig. 3, is fastened rigidly to one end of the shears. Fig. 4 shows a longitudinal section through the head-stock.

The live spindle is shown at K, Fig. 4, to which the cone pulley L is fastened. The live spindle is used to revolve the stock which is to be turned. A driving belt passes over the cone pulley from a counter F, Fig. 3, placed above the lathe, the belt thus turning the spindle to which the cone pulley is fastened. A fork or live centre is placed in the end of the spindle, and one end of the stock that is being turned is driven into this fork and

FIG. 3.

revolves with the spindle. The spindle turns in bearings or boxes shown at M, Fig. 4. This lathe has self-oiling boxes, but generally small oil holes are drilled through the top cap of each box, through which oil is supplied to the rubbing surfaces. A few drops of oil should always be put into each oil hole when the lathe is first started. Removable caps or plugs are generally used to keep dust out of the oil holes.

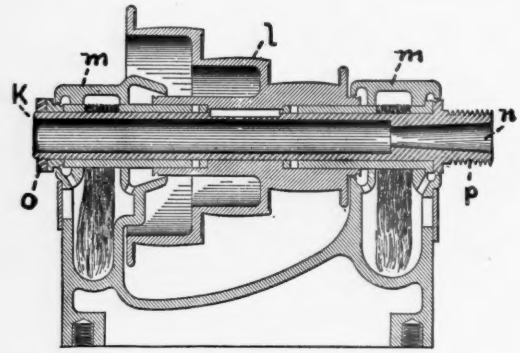


Fig. 4.

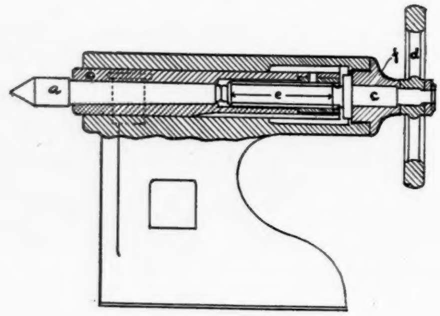


Fig. 5.

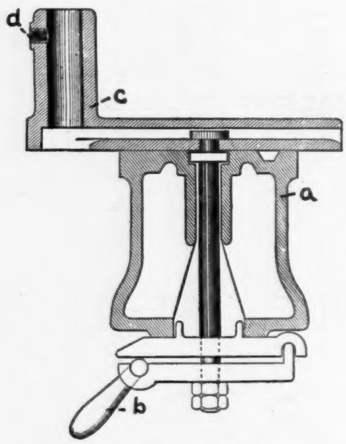


Fig. 6.

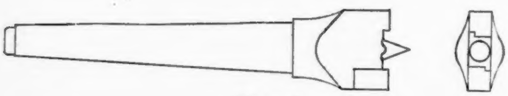


Fig. 7.

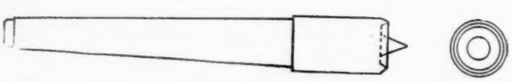


Fig. 8.

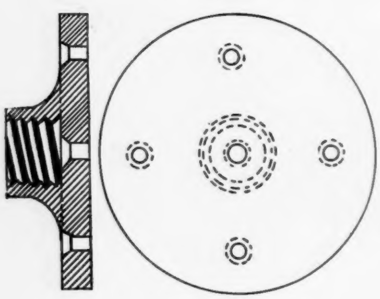


Fig. 9.

Fig. 10.

The live spindle is usually made hollow, with a tapered hole, N, at one end. into which the live centre, which is cut to a corresponding taper, is placed. The live centre can be removed from the spindle by a smart rap from an iron rod passed through the back end of the spindle which is generally hollow. After continued use the spindle may move back and forth somewhat, giving what is known as "end movement." An adjusting screw or collar, O, will prevent this. The screw thread shown at end of the spindle at P, Fig. 4. is used for the attachment of face plates shown at H and J, Fig. 3.

The tail stock, shown at B, Fig. 3, and in section in Fig. 5, supports the tail spindle. The tail spindle holds the dead centre, so called because it does not revolve, as does the head centre. The stock to be turned revolves between this dead centre and the head centre of the head stock.

The tail stock may be fixed in any desired position on the shears by means of a clamp. The spindle B, Fig. 5, may be forced out from, or drawn back into, the tail stock by means of the screw thread on the shaft, C, Fig. 5. This screw thread on the shaft C, which fits exactly a tapped hole in the tail spindle, takes up the space E, Fig. 5. The hand wheel, D, is used for this movement of the psindle. The spindle can be clamped so as to prevent further movement by a clamp handle, shown just above the letter B, Fig. 3. If the handle, D, be turned until the back end of the dead centre, A, Fig. 5, strikes the front end of the screw on shaft, C, the dead centre will be loosened in the spindle, and may then be taken out. An oil hole, F, is used for oiling the shaft, C.

The rest, shown in Fig. 6, supports and assists in guiding the cutting tool. The casting, A, is adjustable along the shears in the same manner as the tail stock; being fastened, together with the tee holder, C, in any desired position by means of the clamp handle, B. As can be seen from Fig. 6, the tee holder, C, can be moved in any direction desired, and as the tee, G, Fig. 3, is movable in the tee holder, the rest has practically universal adjustment. The distance of the tee from the work is thus regulated, and its height and angle with the stock to be turned are regulated by the set-screw which fits into the tapped hole at D, Fig. 5. Fig. 7 shows two views of a fork centre, or head centre, and Fig. 8 shows two views of a cup centre, or tail centre.

The head centre is used in the live spindle to make the work revolve, one end of the wood being driven onto this head centre by a mallet, the tail centre being brought up against the other end. This tail centre is held in the spindle of the tail stock, and as this spindle does not revolve, the tail centre is often spoken of as the dead centre. Fig. 5 shows that the end of the tail spindle has a tapered hole to fit the taper of the tail centre.

Fig. 9 shows one form of a face plate. This is used when the stock to be turned cannot be held between centres. At one end it is tapped out to fit the thread at the end of the live spindle, P, Fig. 4. It is used in turning cups, balls, and such hollow pieces as require that turning tools be used on one end. Generally this class of work is not fastened directly to this face plate, but is held in a block of wood, or disc, fastened to the face plate by wooden screws, and hollowed out so as to hold the work. This wooden disc is called a chuck. The face plates are of various sizes to accommodate different classes of work.

The size of a lathe is determined by two things, the swing, and the length of the shears. The swing of a lathe is twice the distance from the centre of the spur of the live centre to the nearest point of the shears. For instance, a lathe is advertised as having an 11″ swing and a 4′ bed. Nothing over 11″ in diameter could be turned on such a lathe, while the greatest distance obtainable between centres would probably be not over 27″.

TOOLS.

As advancement in wood turning must be made step by step, a few simple tools are all that is necessary for the first efforts. These will consist of a few gouges and chisels, and a parting tool, shown in Fig. 10. These are made purposely for such work, and may be obtained from any well equipped hardware store.

The following tools make a very satisfactory set: 1 skew chisel and 1 turner's gouge, each 1″ wide; 1 skew chisel and 1 turner's gouge, each $\frac{3}{4}$″ wide; 1 skew chisel and 1 turner's gouge, each $\frac{1}{2}$″ wide; 1 skew chisel and 1 turner's gouge, each $\frac{1}{4}$″ wide; 1 round nose chisel $\frac{1}{4}$″ wide; 1 parting tool $\frac{1}{8}$″

wide; 1 pair wing calipers, 6″; 1 pair wing dividers, 6″; 1 wooden mallet, light weight; 1 oil can; 1 oil stove; 1 oil-stone slip.

The gouges, chisels, and parting tool should be fitted with good stout handles in about the proportion shown in the illustrations. For large sizes the handles should be long so as to give good command of the tool when taking a heavy cut. Generally turning tools are sold with the handles already fitted.

The gouge, A, Fig. 10, is the most valuable tool to the wood turner. Any piece that is to be turned is first rapidly brought to a cylindrical form by means of the gouge, and many surfaces having double curves are shaped by its use. Gouges must be well rounded on the cutting edge, and the bevel should be perfectly straight as it is the guide by means of which the depth and shape of curves are regulated. The edge should be a smooth curve, elliptical in shape, so that the gouge may be turned in a small space. The size of a gouge is measured by the width across the concave side, and varies from $\frac{1}{8}$″ to 1″ by eighths of an inch, and from 1″ to 3″ by quarters of an inch.

The skew chisel, or side tool, B, Fig. 10, as it is often called, is a most effective tool, and is used in finishing straight outlined work, such as the cylinder and the cone, and for making convex curves and beads. These chisels are ground with a bevel on both sides, and at an angle of 35° to their edges. The cutting edge, instead of being at right angles with the side of the tool, is skewed somewhat. This gives better command of the cutting, as it allows a better position of the handle. The bevel must be even all its length, and not made more obtuse as it approaches the cutting edge, as by this is regulated the depth of the cut. This is a very important point, and the beginner must not fail to attend to it. The best of wood turners find it difficult to obtain good results by the use of tools that are not properly ground, and this being the case, how much more difficult it must be for the beginner to do even a passable job if the tools are in bad condition. The size of the skew chisel is measured by the width of the blade. The large sizes should have long handles. The bevel on both sides permits of the reversing of the tool. This will be found to be of great value, a they can then be used in either direction.

The parting tool, or cutting off tool, C, Fig. 10, is used for cutting off finished work. The parting tool is measured by the width across the face, the ordinary parting tool being $\frac{1}{8}$″ wide. This tool is very often used for making narrow grooves having, at the bottom, diameters equal to some of the more important dimensions of the finished work, the measurements being taken by a pair of calipers. Later on the general outline is brought down to these grooves.

The round nose chisel, D, Fig. 10, is generally made by grinding an ordinary carpenter's chisel to the elliptical form of a gouge. This tool is used in place of the gouge for most face plate work, and especially for cutting recesses where the gouge would be apt to catch in the wood, and so spoil the work.

The next article will take up the sharpening of the tools, and the first one of a series of exercises, in which I hope to make plain the elementary principles of wood turning.

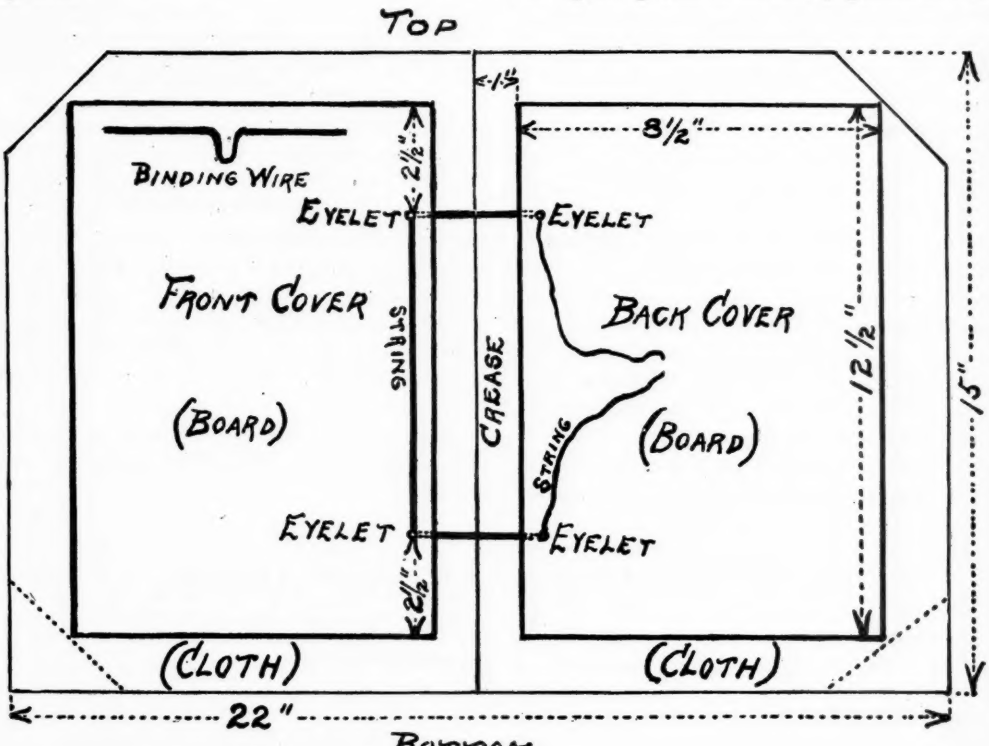
A German electrical journal describes a new galvanic cell which "inhales" the oxygen of the air. The cell contains, in a saturated ammonium chloride solution, a zinc rod and a porous pot provided with a semi-porous membrane. Within the porous vessel is placed a retort carbon, and the vessel contains a special depolarizing liquid. This depolarizing liquid constitutes a sort of chemical sponge, which, when in the air, absorbs the oxygen thereof, and gives it off again in the process of depolarization. The depolarizer consists of ammonium cuprate.

Consul-General O. J. D. Hughes reports from Coburg, that experiments were recently carried out at a colliery, near Saarbrucken, Germany, with lime, tar, and carbolineum to determine the respective value thereof as preservatives of mine timber against rot. Lime was found to be of the least value, while coal tar, although insuring perfect perservation of the surface of the timber, failed to protect the interior, which in every instance was found to be seriously attacked by rot. Carbolineum, however, gave excellent results, provided the timber coated had been previously barked and well dried.

A BINDER FOR MAGAZINES.

Charles J. Bagley.

Those who prefer to keep their numbers of Amateur Work in a cover, in book form, rather than to leave them loose, can make a convenient binder to take each number as it comes from the publishers, thus keeping the file complete and doing away with the chances of losing any of the magazines.



The measurements given are suitable for Amateur Work, and the reader will understand that they can be changed so as to make a cover to hold sheet music, or anything of a similar nature.

Get two pieces of millboard, such as is used for book covers, $12\frac{1}{2}''$ by $8\frac{1}{2}''$, and a little less than $\frac{1}{8}''$ thick. Photographic mounts can be procured which will answer the purpose. In one long side of each piece punch two holes and put in two open metal eyelets, about $2\frac{1}{2}''$ from each end and $\frac{1}{2}''$ from the edge (your family lawyer or the shoemaker will have the machine with which to do this). Get from a book binder or a binders' supply house a piece of book cloth 22″ by 15″. The lighter grades of keratol, pegamoid or other imitation leathers, to be obtained at an upholsterers, will answer admirably in place of book cloth. Fold and lightly crease the cloth across the short way in the middle, with the right side of the cloth out. Open the cloth again and make four lines parallel with the crease, on the wrong side of the cloth, two of them one inch from the crease on each side of it and two of them two

inches from it; also mark the boards an inch from the edge where the eyelets are. Quickly put good paste on one of the boards up to this line and on half the wrong side of the cloth up to the two inch line. Join the two pasted surfaces, placing the eyelet edge of the board on the line one inch from the centre crease of the cloth, and leaving an equal amount of the cloth above and below the board. Turn over the cloth and board and rub the cloth down tight so as to remove any bubbles and have the cloth smooth and fast to the board. Turn over again, and treat the other half of the cloth and the other board in the same way. Then cut the corners of the cloth on an angle, as shown at the top of the drawing, escaping the corners of the board about $\frac{1}{8}''$. Fold over top and bottom of cloth all the way across and paste down, then the ends the same. Be sure the cloth is pasted tight to the board, especially at the edges, where it is most likely to loosen when being folded over. After all is dry, the cover will look more finished if a piece of tinted or fancy paper is pasted on the inside of each cover nearly to the edges and over the edges of the cloth.

These measurements will make a cover which will have a capacity of two inches in thickness (about three volumes of AMATEUR WORK) and will leave a space of about $\frac{3}{4}''$ around the edges of the magazine for protection. Each number of the magazine will require two pieces of wire to hold it in place. Get a spool of flexible wire, brass or tinned iron, about No. 22, and cut off several two inch pieces. With pliers make a U loop in the centre, 3-16″ deep and $\frac{1}{8}''$ across the opening. Open the magazine in the middle, and cut two slits a trifle over $\frac{1}{8}''$ long in the fold of the paper through the back, the length of the slits pointing up and down the magazine. These slits must be cut at such points as will be directly opposite the eyelets when the magazine is in the centre of the cover. Open the cover; pass the ends of an ordinary new shoe string down through the eyelets in the front cover of the binder. Pass the U loop of the wires through the slits in the paper so that they protrude through the back of the magazine when it is closed. Put the string through these loops from the front of the magazine toward the back, and then up through the opposite eyelets in the back cover, pull them tight and tie the two ends together.

Any single number of the magazine, when several are fastened in the binder, can easily be taken out without disturbing the others, by loosening the strings, opening the desired number in the middle, pulling the string up through the slits and slipping the wire from under it. Or in the opposite manner a number may be placed in the binder between others, by pulling the loosened string up through the slits, introducing the wires under the loops of string, and then drawing the string tight.

An appropriate title can be painted on the cover with enamel paint, which dries quickly and will not easily wear off.

HOW TO MAKE AN AQUARIUM.

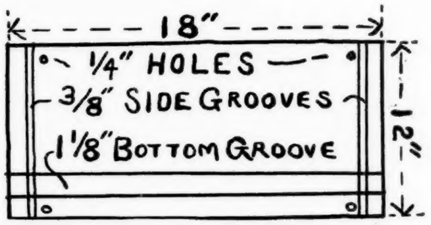
FRANK BALSH.

Few things are more interesting to the young lover of nature than a well stocked and properly cared for aquarium. I trust, therefore, that the following directions for making one, will not be without interest to the readers of AMATEUR WORK.

The tank is constructed of slate and plate glass and is not beyond the powers of the ordinary amateur mechanic.

First procure some slate free from flaws. The three pieces which will be wanted can be bought from any slate dealer at small cost. A slab 36″ long, 18″ wide and about 1″ thick, will be required for the bottom, and pieces 18″ by 12″ for the two ends. At 1″ from the broad part of the ends, cut a groove $1\frac{1}{8}''$ wide and $\frac{1}{2}''$ deep. This groove can be cut with a saw as follows: First mark where you wish to cut with an awl, then lay the slate on

a table or bench, and screw two strips of hard wood in such a manner that the mark on the slate will come between the strips; their distance apart should be the thickness of the saw. When both lines have been sawed to the right depth, the slate between them can be cut out with an old chisel and hammer. These grooves are for the ends of the bottom.



END OF TANK.

After you have cut the above grooves, you can cut grooves $\frac{1}{2}''$ deep and $\frac{3}{8}''$ wide along both sides of the bottom, and of each end piece, at a distance of $\frac{7}{8}''$ from the edge, for the plate glass sides. Now bore four holes $\frac{1}{4}''$ in diameter in each end piece. Two of these holes should be placed about $1\frac{1}{4}''$ from the edge and $\frac{3}{8}''$ below the groove first made to receive the bottom, and two quite near the top, just inside the groove for the glass.

These holes are for the brass rods which hold the tank together. The rods or bolts should be $\frac{1}{4}''$ in diameter and about $38\frac{1}{4}''$ long. They should be threaded for about 1″ on both ends, and fitted with nuts.

The finished end is shown above.

You can now proceed to put the tank together. First partly fill all the grooves with cement made as follows:—1 pint of plaster of paris, 1 pint of best litharge, 1 pint of fine white sand, $\frac{1}{3}$ pint of powdered resin.

The above when used should be mixed with boiled oil and driers to a stiff putty.

After placing a little of this cement in all the grooves, raise the bottom on blocks of wood, and with the help of a friend, you can easily slip the glass, ends and brass rods into position. And when you have done so, screw up the nuts on the rods with your fingers only. Carefully fill all grooves, empty spaces and cracks with cement and your aquarium is finished.

It will be noted that this aquarium makes no provision for running water, as for most purposes this is not necessary, the oxygen being provided by plant life which may easily be secured from nearby ponds.

RULES FOR MAKING GLUE.

GLUE, being an animal substance, must be kept sweet. To do this it is necessary to keep it cool after it is once dissolved and not in use. In all cases keep the glue kettle clean and sweet by cleaning it often.

Good glue requires more water than poor, consequently you can not dissolve six pounds of good glue in the same quantity of water that you can six pounds of poor. The best glue will require from one-half to more than double the water that is required with poor glue, which is clear and red, and the quality of which can be discovered by breaking a piece. If good it will break hard and tough, and when broken will be irregular on the broken edge. If poor it will break comparatively easy, leaving a smooth, straight edge.

In dissolving glue it is best to weigh the glue and weigh or measure the water. If not done there is a liability of getting more glue than the water can properly dissolve. It is a good plan, when once the quantity of water that any sample of glue will take up has been ascertained, to put the glue and water together at least six hours before heat is applied, and if it is not soft enough then let it remain longer in soak, for there is no danger to good glue remaining in pure water even for 48 hours.

The advantage of frozen glue is that it can be made up at once, on account of its being so porous. Frozen glue of same grade is as strong as if dried.

If glue is of first-rate quality it can be used on most kinds of wood work very thin, and make the joint as strong as the original. White glue is made white by bleaching.

If you entertain the supposition that any real success, in great things or in small, ever was or could be wrested from Fortune by fits and starts, leave that wrong idea here.—*Bleak House.*

PHOTOGRAPHY.

TURNING PHOTOGRAPHS INTO SKETCHES.

ALLEN DEBEVOISE.—In the Photo-American.

The essential parts of a photographic print are often wanted in preparing advertisements and other matter partly in type, and though I cannot draw very well I am making all needed sketches by an old process that answers very well and is quickly done. Sometimes we print on such rough paper that half tone engravings such as are used in many magazines, would not show detail at all, but be a mere blotch of black, and then we have recourse to line work if at no other time. Tell you how 'tis done? With pleasure. I buy sheets of salted and sized paper (Clemons) at the stock house. I mix the following sensitizing solution, and as it keeps well, ten ounces will do no harm; so into ten ounces of distilled water I drop one ounce of silver nitrate and half an ounce of ammonium nitrate, the whole bath, bottle, water and chemicals costing me sixty cents.

With a tuft of cotton fastened to a glass tube by drawing a loop over the cotton and through the tube I make a good brush. I don't want to get any of it on my fingers for it will turn them black as night, hence I use the Buckles brush, as this cotton and tube is called.

Now, pinning a sheet of paper to a soft pine board I daub about a quarter of an ounce of the sensitizer all over it with the brush, being careful to cover the paper evenly by first stroking down and afterwards going over the whole job crosswise. I do this in a weak light way back from any windows, and when coated, I just hang the 18x22 sheet up and fan it a few minutes till bone dry. Now I have a lot of paper and I cut it up and put it in a tin box where it will keep a few days without discoloring, if a lump of calcium chloride, done up in cotton in a perforated tin pill box, is also placed in the box.

Print this paper as you would aristo. Mark the back of the sheet with crosses in lead pencil before sensitizing, for one can't tell the sensitized side from the other after dry. The print being made, I merely fix it in hypo, wash and dry it, and then trace out the parts I want with a pen charged with Higgins' water-proof ink. Follow all important lines closely, but ignore the rest merely suggesting rather than drawing any detail by hatching or wriggles (I don't know any other name for that stroke), being careful not to block up any part to a dead black. This being completed, and it usually takes me four or five minutes only, the print goes into a bleaching bath made of 10 ounces of water, 100 grains of bichloride of mercury and a good pinch of salt. I never weigh or measure this bath, any strength will do. In this bath all traces of the silver image fade away, leaving nothing but my drawing, and presto! 'tis done. Wash a few moments, dry, add a touch here and there that was forgotten, and the line drawing or sketch is ready to use. The engraver makes me a block of it to print as an illustration to my advertisement or other text, but those who do not want blocks can copy the sketch with the camera and develop the plate to great density and then reproduce as many of the sketches as fancy dictates.

If the negative is printed on CC platinotype it will be hard to say what it is, for it cannot be told from a pen and ink drawing. Much amusement and a good knowledge of drawing can readily be had by enjoying this simple process for a change, and the results ought to please. The sensitizer can be kept in any light; it don't spoil it to be in the light; in fact a frequent sunning does it good. If one wishes to tone the prints on this paper some very beautiful effects can be had with a simple bath of gold just neutralized with chalk and a grain of soda bicarbonate. Clemons' formula (to be had at the stock house selling his paper) for the toning bath also gives the best of black or purple black tones. There's a whole lot of fun in this thing, it's cheap and—well what more need be asked?

NEW FOOD PLANTS IN YUCATAN.

"The gardens and fields of Yucatan are filled with succulent vegetables and odorous herbs unknown to the outer world," writes Edward Thompson, U. S. Consul at Progresso. He also advises that in the cultivated fields, at the proper seasons, are grown classes of Indian corn, beans, squashes, and tubers for which we have no name, for the reason that we have never seen or heard of them.

The forests and jungles contain fruits that, excellent even in their wild state, could be made delicious by scientific care and cultivation. There are half a score of wild fruits that offer more promising results than did the bitter wild almond, the progenitor of the peach.

These promising subjects for cultivation should attract the attention of those interested in this line of research and practical work.

The consul holds himself in readiness to supply any person who, or society which, desires the seeds or roots mentioned in these reports for the purpose of study, making only such charges as will cover the actual expense incurred.

The most important of the large cereals is the maize of the Mexicans—the indian corn of the Americans and the ixim of the Mayas of Yucatan. Yucatan has six varieties of this grain, and the Maya Indian reverently speaks of it as the "grace of God." The large stalked, large grained class known to the natives as xnuc nal (pronounced shnook nál) is the most prominent and has by far the greater acreage devoted to its cultivation on the peninsula (Yucatan). It is planted in May, is fully matured in January, and then is left to harden and season until gathered as needed. This class most nearly resembles our indian corn. It has both the white and yellow grains. Under the haphazard methods of the native Indians, the corn produces in the limestone soil of Yucatan from 20 to 30 bushels to the acre. Under favorable conditions, this yield is often doubled.

The "xmehenal" (shmehenál) is a small, quick growing variety, about the size of our pop corn. The plants are rarely 4 feet high. One variety matures within sixty days of its planting, and the second needs but fifteen days more.

The xmehenal xtup (shtoop), planted in May, can be gathered in July, and, while the production per acre does not quite reach the figures of the xnuc nal, it has a greater capacity of resisting the extremes of heat and dryness.

The natives of Yucatan prefer the native corn to that imported from the United States, and will cheerfully pay the higher price demanded in times of scacity.

The plant, or rather the running vine, known as the macal box (makal bosh), produces a tuberous root of great nutritive value. Entire families have lived upon this root for weeks at a time and were healthy and well nourished. This plant is very productive. About the middle of May the green shoots first appear above the earth. They grow rapidly and in November are ready to be dug. The tuber is about the size of a large Irish potato and is of a purplish color, like a certain class of sweet potato. It can be cooked in the same way as the sweet potato. The plant is hardy. A long drought may cause the vine to wither, but with the lightest rain it springs up anew. The roots left in the ground, as too small for food, propagate the plant, and each year the yield increases. It seems to be a kind of native yam; it grows in almost any kind of moderately rich soil, and when cultivated intelligently should be of certain value as a food plant. The xmakin macal (shmakeén makál), like the macal box, appears in May and is gathered in November, but it yields only one or two tubers to the plant. These, however, are of large size, resembling enormous Irish potatoes. I have seen four of these great roots fill a bushel basket. The interior is white and seems to be nearly pure starch. It is planted as we set out potatoes. The plants grow close together, and, while I have no exact figures, the yield per acre should be phenomenal.

Xmehen chi-can (shmehen chi kan) seems to be a kind of artichoke, weighing when mature about a pound. The plants are running vines, rarely more than a yard long. An acre will yield an immense crop under favorable conditions. The plant, sown in August, can be gathered in November.

Xnuc chi-can is a larger root, weighing when mature about three pounds. It is a hardy plant and produces well. Both of these roots are eaten roasted or boiled, and many like them raw.

A SIGNAL TELEGRAPH SYSTEM.

A. G. Holman, M. E.

The proposed system is not an electric telegraph. It occupies a field of its own, and although not having the capacity or refinements of electric devices, it has the honor of an illustrious past and of many respectable modern applications. As compared with electric systems for amateur use, it will be found that it has "legs" in a practical sense, far beyond the financial reach of the average boy in electric fields. For purposes of amusement, and also of practical usefulness and moderate profit, a well arranged signal telegraph still has a place.

The requirements for an acceptable system are easy and cheap construction, a simple alphabet and considerable speed. A signal apparatus fulfilling these conditions and manned by a combination of energetic and trustworthy young men, has a fighting chance for commercial existence, as well as entertainment, even in this electric age. It should not be forgotten when estimating the possible benefits from a semi-business operation organized by young men, that if properly conducted, it will bring them to the favorable notice of business men and lead to desirable engagements that may be fairly counted among the assets of the combination.

A description of the proposed signal system will cover:—

1. An explanation of the necessary characters.
2. The translation of characters into signals.
3. The construction of a miniature apparatus for purposes of practice.
4. Tne construction of a full-sized apparatus.
5. Details of organization and operation for a group of stations.
6. Organization of a Trunk line service.

First. The characters necessary for a convenient and satisfactory miscellaneous business cannot be less then about forty two. These include the letters of the alphabet, the numerals, several punctuation signs and a few special signals for special purposes. It is important that the first step of choosing the characters should be carefully taken, so that it may become a standard code suitable for all future extensions of the system.

The forty two characters may be conveniently arranged in tabular form as shown in Fig. 1.

Second. Translation into signals. If a number is given to each line and to each vertical column, the character at the beginning of each line may be expressed by a single figure, as 1 for A, 2 for E, 3 for I, etc. All the other characters may be expressed by two figures each, giving first the number of line and secondly the number of column, 1-2 for C, 3-3 for L, etc.

Therefore by this expedient of tabulating the characters, the necessary separate signals required to express the entire list has been reduced to six. It will also be noticed that the vowels which are of most frequent occurance, are placed at the beginning of the lines, so that they are expressed by one figure.

Signals→ ↓	1	2	3	4	5	6
1	A	B	C	D	?	-	1
2	E	F	G	H	&	·	2
3	I	J	K	L	M	N	3
4	O	P	Q	R	S	T	4
5	U	V	W	X	Y	Z	5
6	SPACE	7	8	9	0	The	6

Fig. 1.

As the Morse telegraph alphabet, used on electric lines and in flag signals, requires one signal for E, two signals for I, and a greater number for all other letters, it will be seen that if a method can be provided for indicating each of the six figures mentioned by a single signal, much has been accomplished in the line of speed and simplicity.

Third. A miniature apparatus for expressing the six figures by single signals is shown in Fig. 2. Cut from a piece of thin wood the piece marked A, consisting of the main portion, 3 in. square and a handle 3 in. long on one side of the square and formed from the same piece. At the centre a common spool, B, is fastened to the board with a round head screw of proper size so that when firmly in the board, the head will allow the spool to turn. In the side of the spool a wire or small wooden rod, C, about 4 in. long, is firmly fixed, so that when the spool is turned the rod will be swung to different angles. Finally, mark on the board the position of the rod when at the upper and lower left corners and four other positions equally spaced between, and number these marks from 1 to 6 as shown,

and drive small nails partially into the board at corners 1 and 6 to serve as stops for the rod, so that it may be quickly swung to the extreme positions without passing beyond. When not in use the rod can be sprung over the cover nails and placed over the handle for convenience of carrying in the pocket.

With this pocket apparatus, which can be made in a short time and at trifling expense, messages according to the tabulated code, may be rapidly sent as far as the signals can be seen, and will give valuable practice in familiarizing the work while within speaking distance so that suggestions can be exchanged.

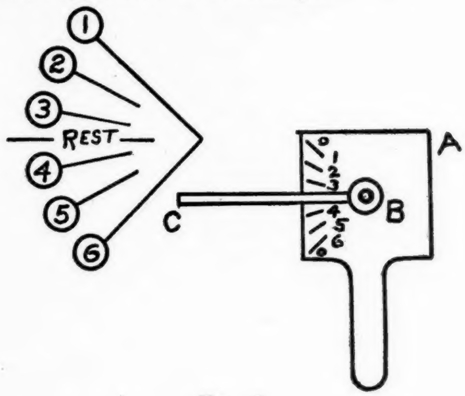


Fig. 2.

To signal the letter A, swing the rod quickly to position 1, and keep it there long enough so that it can be observed, but no longer than necessary. If the next letter to be sent is F (to be indicated by 2–1) swing the rod to 2 and then back to 1. If the next letter following A should be C (indicated by 1–2) bring the rod to the horizontal position of "rest" to show that the previous letter is finished, and then turn successively to 1 and 2. Be careful to leave a distinct space or pause between letters, so that the signals will not be confused. Double figures, like 3–3 for S, are made by swinging rod to 3, then back to "rest" or horizontal position, and again to 3. At the end of each word drop rod to 6, indicating "space." This is more distinct than to depend upon a longer pause to indicate the space, and it also saves time. The signals for the nine numerals and zero all include the signal 6 in the combination, which is a help in recognizing these characters. The word "the" occurs so frequently that time is saved by assigning to it a separate combination, 6–5, requiring two signals instead of spelling it out with five.

The group included within the small square in the table contains all the characters necessary for practical use. "&" may be used in addresses and also for "and" in messages.

The question mark, 1–4, in addition to its ordinary use, is convenient for indicating "what?" if a remark by signals is not understood. The dash, 1-5, is used for commas and other stops in a sentence less prominent than the period, 2–5. The period may also be used without confusion as a decimal point. In making the signals be sure to give the line signal first, followed by the column signal, and make a slight pause between letters.

Sending messages. Confusion will be avoided by acquiring a habit at the outset of following the ordinary telegraph custom in regard to the proper order.

The necessary details are these:—

Begin each message with abbreviation H R (meaning hear?) to indicate that a regular message is coming. Next give successively the number of message, initials of sender, the "check" or number of words in body of message, place sent from, full address, the message and the signature.

The name of sending place should be preceded by "Fm," the address by "To," the message by a period, the signature by "Sig," and the message should end with a period after the signature.

The proper order is indicated in the following line:—

Hr. No, Sender, Check, Fm, To – Message, Sig –

At end of message the receiving station says "O K," followed by initial of the receiving operator.

When an informal message or remark is sent it should always begin as well as end with a period.

The signals to attract the attention of another office may be one of the vowel letters, several times repeated, with the "space" signal between. This will provide five separate "calls" which will accommodate as many stations as would probably ever be within range. If not, a combination of letters, like A E, A I, etc., will supply the necessary number.

When the station called answers "II," proceed with the message.

Messages can be taken before the alphabet is memorized, by simply writing down the figures and afterward filling in the translation.

By forming a small club for practice, stations may be arranged in different rooms or around buildings so that the original sender is out of sight of some of the receiving officers.

A sending instrument which is simply an enlargement of that here described, could be used between neighboring houses or in field work for considerable distances, but for long range certain modifications are desirable, which will be described in another article.

Without any apparatus this alphabet may be used with the swinging of the hand or a cane, to carry on a conversation much beyond speaking distance, and at a higher speed than by the "wig-wag" code.

Regular stations may be established to reach summer resorts, temporary camps, etc., and the curiosity awakened by the unusual operations will be good advertising, and the fad of telegraphic conversation at a trifling charge per message will bring change into the money boxes of the operators.

HOW TO SHAKE CHESTNUT TREES.

The chestnuting season is now at hand, and gathering chestnuts will be one of the pleasures of many readers of this magazine. The simple device here described will make easy the shaking of the long, high branches of the tree, where nuts always seem to be thickest and most difficult to get.

Obtain an iron or lead ball, the latter prefered, about two inches in diameter, and drill a quarter of an inch hole in it. In this hole put one end of a piece of iron rod a quarter of an inch in diameter and eight inches long, and solder securely. Bend the other end of the rod into a small eye. About 150 feet of strong cord will also be needed, one end of which is fastened to the eye in iron rod, and the "shaker" is complete.

To use it, take hold of the cord about two feet from the shaker, and twirl it in a verticle circle until it is moving rapidly, the hold being released so that it will rise over the branch and drop to the ground on the further side. This action has thrown the cord over the branch, and if the two ends are then brought together, the branch can be violently shaken, and the chestnuts will drop to the ground. Before throwing the shaker the cord should be loosely coiled so that it will not snarl when rising. When through shaking, the shaker end of the cord is pulled until all the cord is again on the ground, when it is coiled for another throw. But little practice is required to enable one to direct the shaker quite accurately. Use care that companions are not struck with the shaker, as a most violent blow would result if it was moving rapidly.

The total production of domestic copper in the United States in 1901 was 268,782 long tons.

TRADE NOTES.

Draftsmen who appreciate fine instruments will find it to their interest to secure the catalogue of Kolesch & Co., 138 Fulton St., New York. This firm make a specialty of Swiss instruments, which they offer in a wide variety and at very reasonable prices.

THE amateur or professional workman who delights in having tools of the best grade and design, will find in the Combination Square with dropped forged heads, manufactured by the Brown & Sharpe Mfg. Co., Providence, R. I., a tool which will satisfy their highest ideals of what a tool should be. Descriptive circulars may be obtained of leading hardware dealers or direct upon request.

The screw pitch guage, 4 to 60, manufactured by the Sawyer Tool Mfg. Co., Fitchburg, Mass., is a compact and convenient arrangement of this important tool, and sold at a price which puts it within the reach of all.

The "Bed Rock" planes of the Stanley Rule and Level Co., New Britain, Conn., are designed so that the cutting tool, while adjustable, is held absolutely rigid, and the throat is of less width than with an ordinary plane. These important advantages will be greatly appreciated by those who require high grade tools.

The new line of hand saws now being manufactured by the Simonds Mfg. Co., Fitchburg, Mass, have already established a reputation for quality and finish which will be greatly extended as their sale increases.

A serviceable, well made telephone at a low price has at last been offered for sale by the Atwater Kent Mfg. Wks., Philadelphia, Pa., which may be purchased with confidence by anyone desiring to erect a private line which will stand up under continued service. The rapidly increasing sale of this instrument is evidence that it is meeting the demand which has long been felt for such a telephone. The firm is sending out an artistic card bearing a handsome face of the Gibson tpye, enclosed in a dark card frame with cord for hanging on the wall, making a very attractive ornament for an office.

For artistic design and finish and the highest grade of workmanship and service, the telephone manufactured by the S. H. Couch Co., Summer St., Boston, is a leader. It must be seen to be fully appreciated. It is specially applicable for private line residence or office use, where an attractive appearance is desired. The price is very reasonable when the quality of the instrument is considered. Electrical supply dealers should find it a good seller.

The L. S. Starrett Co., Athol, Mass., are sending out a supplement to their regular catalogue, which presents several new and important tools, for mechanics. Steel measuring taps, folding steel rules with large figures for blacksmiths, folding steel pocket rules, metric screw pitch guages, a variety of new shapes of micrometers, spirit levels, hack saws and blades, a universal test indicator, are described with prices. The tools made by this company are so well known and universally used that new tools of their manufacture are sure to meet with a ready sale.

The amateur or professional who resides where it is difficult to purchase tools and supplies at prices prevailing in large cities will find it desirable to communicate with The Frasse Co., 38 Cortlandt St., New York. This company make a specialty of mail order business and carry a large variety of tools and supplies which are offered at city prices.